REMARKS

This is a response to the Final Office Action mailed June 3, 2004 in relation to the above-identified patent application.

Page 2: Disapproved Terminal Disclaimer

In the Terminal Disclaimer, filed on 1 March 2004, the serial number of the instant application (i.e., 10/016,812) was mistakenly cited. We apologize for this mistake. A new Terminal Disclaimer is respectively submitted in this package wherein the correct serial number of the concerned application (i.e., 09/891,795) is cited.

Page 2: No fee payment of $55 was received in our response of 1 March 2004

We have checked our record and found that a check for the $55 extension fee was submitted along with our 1 March 2004 response. In this package, please find a copy of the cashed check (#5430) – front and back sides. The information on the backside of the check indicated that the check (#5430) was cashed by the Patent and Trademark Office on March 9, 2004.

Terminology Change in the Amended Claims, Abstract, and Specification

To clearly indicate that the so-called "spatial birefringent element" of the instant application consists of multiple device elements, we have amended the Claims, the Abstract, and the Specification, wherein "spatial birefringent element" has been changed to "spatial birefringent device" and "birefringent element assembly" has been changed to "birefringent device assembly".

Page 2, #1: Claims 1, 2, 7-16, 18, 20, 21 based on a disclosure that is not enabling

All independent claims (1, 16, 18, 20, 21) have been amended with structural limitations by citing specific device elements in the spatial birefringent device in a logical order. The structural limitations for the spatial birefringent device can be found in paragraphs [0054] and [0055] of the specification. Further, the dependent claims have been amended to accommodate the changes in the independent claims.

It is respectful to request that the amended claims 1, 2, 7-16, 18, 20, 21 are allowable.

Page 2, #2:

The original claim sentence "...when the two components recombine at the output of the spatial birefringent element a birefringent effect is achieved." has been amended to "...when the two orthogonally polarized components recombine at the output of the spatial birefringent device, a ~~birefringent effect~~ phase delay between the two orthogonally polarized components is achieved." in all related claims. This amendment clearly indicates that the specific birefringent effect, achieved by the spatial birefringent device of the instant application, is the phase delay but not the polarization/beam separation since the two orthogonally polarized components recombine at the output of the spatial birefringent device.

Page 4, #3: Claims 1, 7, 8, 10, 12-14, 16, 18, and 21 are rejected under 35 U.S.C. 102 (e) as being anticipate by Chang et al (6,335,830).

With regard to claim 1:

It is respectful to submit that the so-called "spatial birefringent elements" (400, 492, 490) in Fig.4a and other figures of Chang's (6,335,830) are "optical beam spatial separators" (for 400) or "optical beam spatial recombiners" (for 492 and 490). The structures and functionality of these "spatial birefringent elements" (400, 492, 490) are completely different from the spatial birefringent devices of the instant application.

Structure Difference: For the spatial birefringent devices of the instant application, they consist of a polarization beam splitter (PBS, 19a in Fig.1), two polarization rotators (i.e., 22a and 23a in Fig.1), and two reflectors (i.e., 14a and 15a in Fig.1). In comparison, for the "spatial birefringent elements" (400, 492, 490) in Fig.4a, they are polarization beam displacers, which are the same element 10 and 11 (beam displacers) used in the instant application (see Fig.1).

Functionality Difference: At the exit of 400, the two separated beams are not recombined (i.e., 1 input → 2 outputs). At the input of 492 and 490, there are two separate input beams (i.e., 2 inputs → 1 output). In comparison, in the spatial birefringent device of the instant application, one input leads to one output (i.e., 1 input → 1 output): the input is first separated into two orthogonally polarized components, a phase delay is introduced between the two orthogonally

polarized components before the two orthogonally polarized components recombine at the output of the spatial birefringent device.

It is respectfully submitted that the combination of 400, 492, 490 is not a spatial birefringent device either in the instant application since during the beams' propagation, they experienced additional birefringent effects at elements 424 and 426 (birefringent crystals), rather than a simple optical path length difference (phase delay) between the two orthogonally polarized components.

Claim 1 has been amended to better define the spatial birefringent device of the instant application, which are in sharp distinction (in both structure and functionality) with the "spatial birefringent elements" 400, 492, and 490 of Fig.4a and other figures of Chang's (6,335,830).

It is respectful to request that claim 1 (amended) is allowable.

With regard to claim 7:

As amended claim 1 has clearly defined the spatial birefringent device of the instant application, which are in sharp distinction (in both structure and functionality) with the "spatial birefringent elements" 400, 492, and 490 of Chang's (6,335,830), it is respectfully requested that claim 7 (amended) is allowable.

With regard to claims 8 and 10:

It is respectfully submitted that the spatial birefringent devices of the instant application (described in both the specification and amended claim 1) do not exist in Chang's (6,335,830). Claims 8 and 10 have been amended to specifically refer to the spatial birefringent devices of the instant application. Thus, it is respectful to request that dependent claims 8 and 10 (amended) are allowable.

With regard to claim 12:

It is respectfully submitted that the spatial birefringent devices of the instant application (described in both the specification and amended claim 1) do not exist in Chang's (6,335,830). As amended claim 1 has clearly defined the spatial birefringent device of the instant application, it is respectfully requested that claim 12 (amended) is allowable.

With regard to claims 13 and 14:

It is respectfully submitted that the spatial birefringent devices of the instant application (described in both the specification and amended claim 1) do not exist in Chang's (6,335,830). Dependent claims 13 and 14 have been amended to specifically refer to that "two separate light

paths are defined for the two orthogonally polarized components, respectively, within the spatial birefringent device" wherein the spatial birefringent device is described in amended independent claim 1. This type of spatial birefringent devices (i.e., one polarization beam splitter / PBS + 2 polarization rotators + 2 reflectors) do not exist in Chang's ('830). It is respectful to request that dependent claims 13 and 14 (amended) are allowable.

With regard to claim 16:

Similar to independent claim 1, independent claim 16 has been amended to clearly define the spatial birefringent device of the instant application, which is in sharp distinction (in both structure and functionality) with the so-called "spatial birefringent elements" 400, 492, and 490 of Fig.4a and other figures of Chang's (6,335,830). It is respectfully submitted that the spatial birefringent devices of the instant application (described in both the specification and amended claim 16: Structure = 1 PBS + 2 polarization rotators + 2 reflectors and Functionality = polarization beam separation + phase delay + polarization beam recombination) do not exist in Chang's (6,335,830). It is respectful to request that claim 16 (amended) is allowable.

With regard to claim 17:

Claim 17 was previously cancelled.

With regard to claim 18:

Claim 16 has been amended to clearly define how to use the spatial birefringent device of the instant application to achieve channel interleaving, wherein the spatial birefringent device of the instant application is clearly defined and is in sharp distinction (in both structure and functionality) with those of Chang's (6,335,830). It is respectfully submitted that the spatial birefringent devices of the instant application (described in both the specification and amended claim 18: Structure = 1 PBS + 2 polarization rotators + 2 reflectors and Functionality = polarization beam separation + phase delay + polarization beam recombination) do not exist in Chang's teaching (6,335,830). It is respectful to request that claim 18 (amended) is allowable.

With regard to claim 21:

Independent claim 21 has been amended to clearly define the spatial birefringent device of the instant application, which are in sharp distinction (in both structure and functionality) with those of Chang's (6,335,830). It is respectfully submitted that the spatial birefringent devices of the instant application (described in both the specification and amended claim 21: Structure = 1 PBS + 2 polarization rotators + 2 reflectors and Functionality = polarization beam separation +

phase delay + polarization beam recombination) do not exist in Chang's (6,335,830). It is respectful to request that claim 21 (amended) is allowable.

Page 7, #4: Claims 2 and 5 are rejected as being unpatentable over Chang's (6,335,830) in view of Applicant's Admitted Prior Art.

Claim 2 is a dependent claim on claim 1. Independent claim 1 has been amended to clearly define the spatial birefringent device of the instant application, which is in sharp distinction (in both structure and functionality) with those of Chang's (6,335,830). It is respectfully submitted that the spatial birefringent devices of the instant application (described in both the specification and amended claim 1: Structure = 1 PBS + 2 polarization rotators + 2 reflectors and Functionality = polarization beam separation + phase delay + polarization beam recombination) do not exist in Chang's (6,335,830). Claim 1 and 2 have been amended to clear indicate that the outputs related to claim 2 are two interim output components in order to distinct with other output components from other elements in the apparatus of the instant application. It is respectful to request that claim 2 (amended) is allowable.

Claim 5 was previously canceled.

Page 8, #5: Claims 9, 11, and 20 are rejected as being unpatentable over Chang's (6,335,830).

With regard to claims 9 and 11:

Claims 9 and 11 are dependent claim on claim 1. Independent claim 1 has been amended to clearly define the spatial birefringent device of the instant application, which is in sharp distinction (in both structure and functionality) with those of Chang's (6,335,830). It is respectfully submitted that the spatial birefringent devices of the instant application (described in both the specification and amended claim 1: Structure = 1 PBS + 2 polarization rotators + 2 reflectors and Functionality = polarization beam separation + phase delay + polarization beam recombination) do not exist in Chang's (6,335,830). Claims 9 and 11 have been amended to specifically refer to the spatial birefringent devices of the instant application. Thus, it is respectful to request that dependent claims 9 and 11 (amended) are allowable.

With regard to claim 20:

Independent claim 20 has been amended to clearly define the spatial birefringent device of the instant application, which is in sharp distinction (in both structure and functionality) with those of Chang's (6,335,830). It is respectfully submitted that the spatial birefringent devices of the instant application (described in both the specification and amended claim 21: Structure = 1 PBS + 2 polarization rotators + 2 reflectors and Functionality = polarization beam separation + phase delay + polarization beam recombination) do not exist in Chang's (6,335,830). It is respectful to request that claim 20 (amended) is allowable.

Page 9, #6: Claim 15 is rejected as being unpatentable over Chang's (6,335,830) in view of Lahat's (6,417,944).

Claim 15 is a dependent claim on claim 1. Independent claim 1 has been amended to clearly define the spatial birefringent device of the instant application, which is in sharp distinction (in both structure and functionality) with those of Chang's (6,335,830). It is respectfully submitted that the spatial birefringent devices of the instant application (described in both the specification and amended claim 1: Structure = 1 PBS + 2 polarization rotators + 2 reflectors and Functionality = polarization beam separation + phase delay + polarization beam recombination) do not exist in Chang's (6,335,830).

It is respectful to submit that cited reference of Chang (6,335,830) teaches an apparatus or a method to use conventional birefringent crystals (i.e., 424 and 426 in Fig.4), to construct an interleaver. The instant application discloses a new technology using spatial birefringent devices that are fundamentally different with the cited reference. None of the elements in the cited reference (Chang's 6,335,830) is spatial birefringent device per definition and description in the specification and the amended claim 1 of the instant application.

It is respectful to submit that Chang's patent actually cannot provide tunable channel spacing due to its inherent limitation. The channel spacing is determined by the phase delay (e.g., Γ) of the first birefringent element in an interleaver. In Chang's apparatus, the channel spacing is determined by the phase delay of 424 (Fig. 4a) and 424 is a birefringent crystal. The phase delay in a birefringent crystal is fixed and is not tunable. Thus, the channel spacing is fixed in Chang's apparatus.

In comparison, the instant application discloses an interleaver using spatial birefringent devices, where the birefringent phase delay can be changed. For example, by changing the

relative positions of 15a and 14a, distances L_1 and L_2 (see Fig.1) are changed. As a consequence, the spatial birefringent phase delay is changed and thus the channel spacing is tuned in this invention. Another tuning method is to have liquids (of different refractive index) in the spacing between 19a and 14a (or in the spacing between 19a and 15a) to change the birefringent phase delay in order to achieve tunable channel spacing.

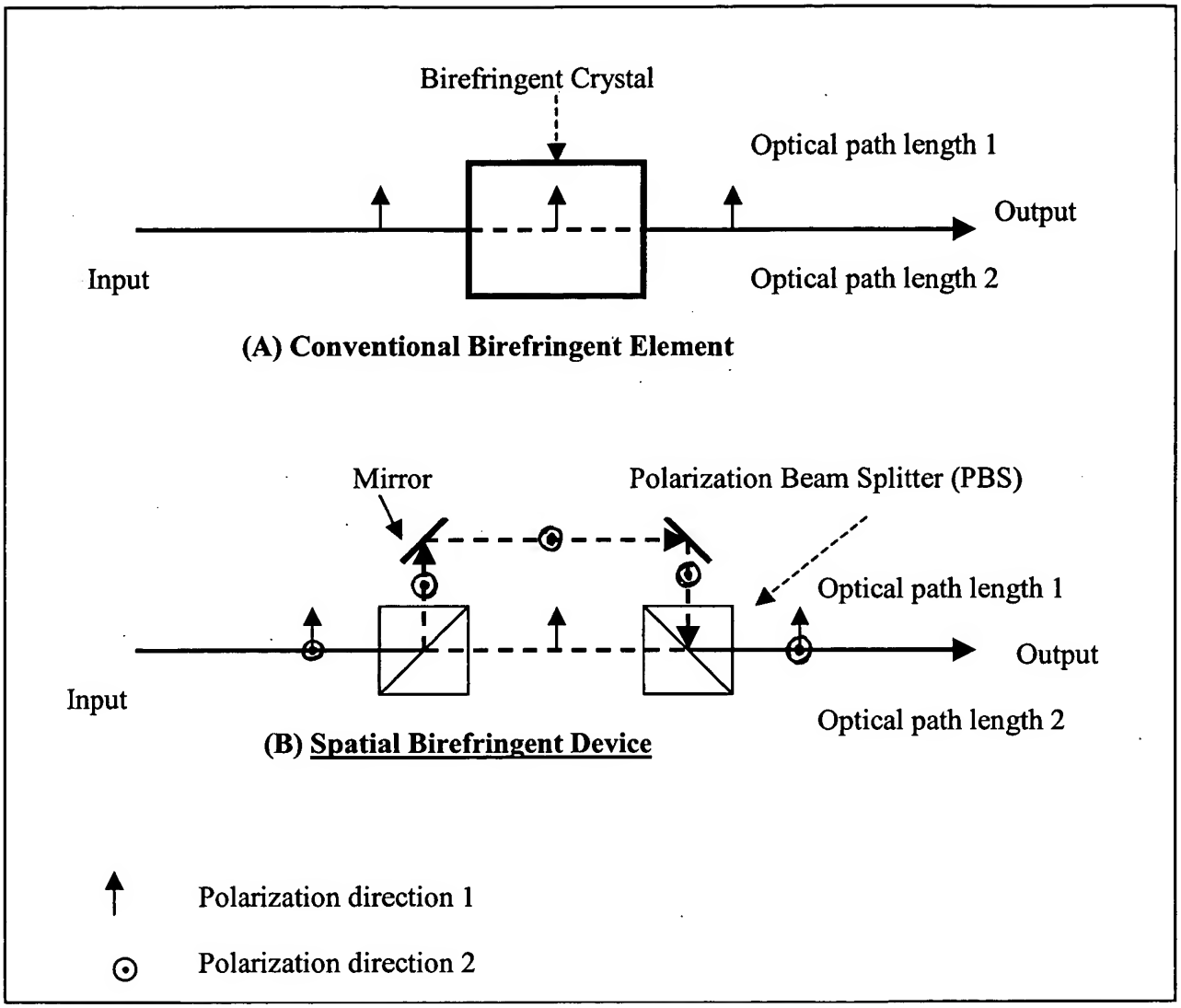
Chang's patent cannot provide the channel spacing tuning capability. Thus, it is respectful to request that claim 15 is allowable.

Page 9, #8: Double Patenting Rejection

A new Terminal Disclaimer which disclaims the terminal portion of any patent issuing on the subject patent application that extends beyond the termination of any patent issuing upon U.S. application serial no. 09/891,795 and which requires co-ownership of such patents is provided herewith to obviate the double patenting rejection of the subject patent application.

Further Note on Spatial Birefringent Device

Conventional birefringent crystal and spatial birefringent device are two different types of technology. The following figure are exemplary diagrams illustrating their different working principle. In the upper part of the figure (A), an optical input beam propagates through a conventional birefringent element (e.g, a birefringent crystal). Birefringence (phase delay) is obtained for two orthogonally polarized optical components without physical or spatial separation of the two components as they pass through the birefringent element. The birefringence (phase delay) is inherently provided to the two components by the birefringent crystal.



Comparison: conventional birefringent element /crystal vs. spatial birefringent device

In the lower part of the figure (B) for a spatial birefringent device, an optical input beam is first separated into two orthogonally polarized components (e.g., by a polarization beam splitter - PBS). Each component propagates through a different physical route, which are spatially separated. Then, the two components are recombined (e.g., by another PBS). In a spatial birefringent device, the birefringence (phase delay between the two components) is obtained by having the two optical components travel with different optical path lengths before they are recombined.

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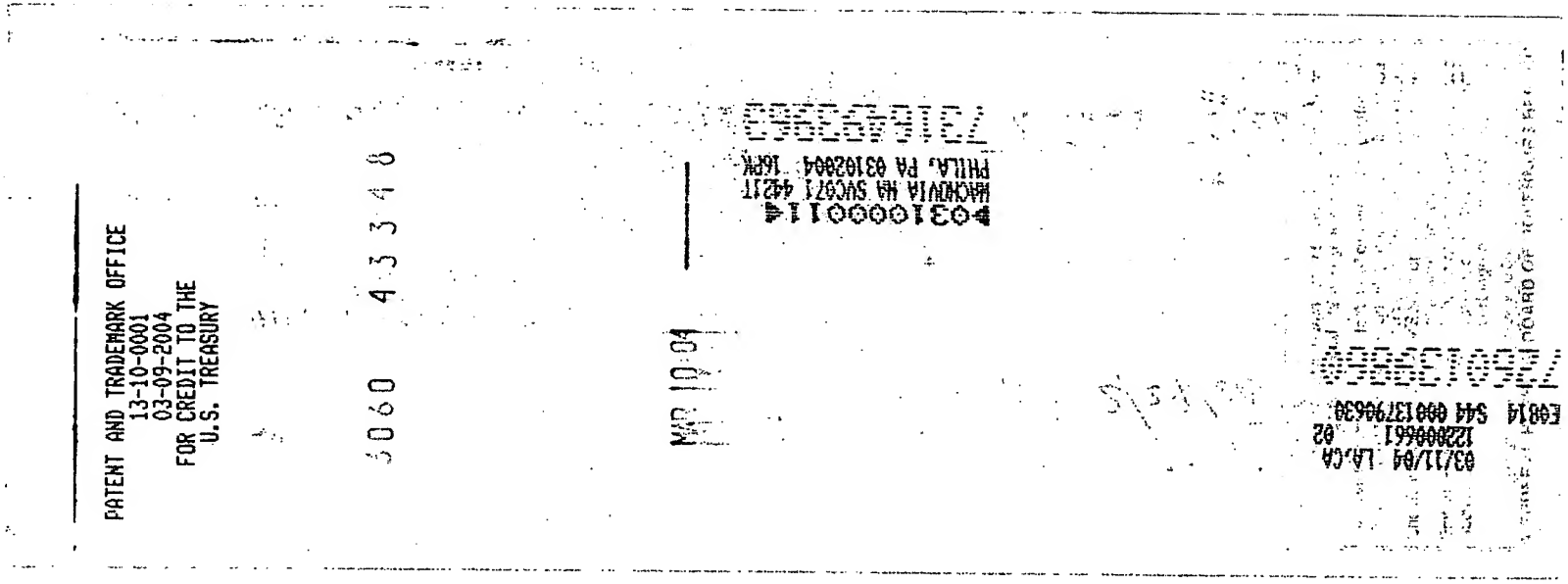

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